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Effect of Confinement and Green Feed on Number and Hatchability of Eggs

Horace Atwood

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1.—Confining hens to their houses during the two winters covered by this report proved detrimental both as to the number of eggs laid and their hatchability. This practice, under West Virginia conditions, seems to be of doubtful value.

2.—Whether oats are fed dry or sprouted seems to have little or no effect upon the number of eggs laid.

3.—Sprouted oats added to a poultry ration in winter increased the fertility and hatchability of the eggs.

4.—On account of its beneficial effect upon hatchability in the first test and its effect upon egg production in the second, it would seem that when corn silage is available a small amount may be fed to laying hens in winter to advantage.

5.—Dried beet pulp was not relished by fowls and is of questionable value in poultry feeding.

6.—Semi-solid buttermilk as a protein concentrate gave good results with respect to the health of the fowls and the number and hatchability of eggs laid.

BY
HORACE ATWOOD

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Effect of Confinement and Green Feed on Number and Hatchability of Eggs

Do hens lay better in winter if confined to their houses, or should they be allowed to run outside? If they should be confined then this practice should be followed generally, since little or no additional expense is involved in keeping them shut in and even a few additional eggs add considerably to the income on account of their high value during the winter season.

From an experimental standpoint this question is not so simple as it might first appear, as it is possible that the severity or mildness of the winter, the exposure, the kind of poultry houses provided, and possibly other factors such as the breed, or the individual hardiness of the fowls may influence the results. Consequently, it is scarcely to be expected that the results of one experiment however conclusive will be generally appliable to all conditions and to all sections of a state like West Virginia with its widely varying altitudes.

The first experiment herein described was conducted during the winter of 1920-21 at the Experiment Station Farm at Morgantown. This farm has an elevation of 1,250 feet, and the poultry yards are sheltered but little from the wind.

Colony houses of the shed roof type were used in this test. These were 9 feet wide by 18 feet long and had two windows and a door in front. They faced southwest, and were ventilated by a drop door in the east end about 1 foot wide and 8 feet long. This door was kept open or partly open nearly all winter. Each house was provided with a yard or run 30 feet wide by 100 feet long.

The experiment was started December 1, 1920, when 90 single-comb White Leghorn yearling hens and 6 cockerels were divided into six uniform lots and placed in the six houses provided for them. They were fed dry mash in hoppers, and once per day a mixture of corn and oats was scattered in the litter covering the floors of the poultry houses.

Lots 1, 2, and 3 were confined to their houses while Lots 4, 5, and 6 had uninterrupted access to their respective yards. The ex-

periment proper for the first yea inated June 1, although to study further the influence of co, ent and green feed on the size, fertility, and hatchability of ggs, Pens 1, 2, and 3 were confined two months longer.

A record was kept of the kind and amount of feed consumed each month, the weight of the fowls, the number and weight of the eggs laid, and in the spring several hatches were made of the eggs.

FEEDING THE FOWLS

The dry mash fed in hoppers was composed of 2 parts corn meal and 1 part each of wheat bran, wheat middlings, and meat scrap. The hoppers were kept open continuously during the day. The whole grain consisted of a mixture of 2 parts corn and 1 part oats by weight. This was fed in the afternoon and an effort was made to feed about the same amount of whole grain to each pen each month.

In addition to the basic ration, Pen 1 received sprouted oats daily during the test, Pen 2 corn silage, and Pen 3 no green feed. During December and January, Pen 4 received sprouted oats, Pen 5 corn silage, and Pen 6 no green feed. During the next two months, Pen 5 received sprouted oats, Pen 6 corn silage, and Pen 4 no green feed, and during the next two months of the test Pen 4 received corn silage, Pen 5 no green feed, and Pen 6 sprouted oats.

The following table shows the amount and kind of feed consumed by each pen for the six months of the test:

TABLE 1.—Amount and Kind of Feed Consumed

Pen	Lbs. Mash	Lbs. Corn	Lbs. Oats	Lbs. Sprouted Oats*	Lbs. Corn Silage	Total Except Silage
1	330	120	60	90		600
2	247	113	146		185	506
3	284	116	147			547
4	337	114	116	30	61	597
5	340	114	117	30	62	601
6	308	122	121	30	59	581
Total	1846	699	707	180	367	3432

*Weight before sprouting.

Without taking into consideration the silage, the three pens which were confined consumed 1,653 pounds of feed and the other three pens 1,779 pounds, or at an average rate of 71.4 pounds of feed per bird per year. The increased consumption of feed of the birds running out may have been owing to the greater amount of exercise they took.

The pens receiving silage consumed an average of 89.6 pounds of grain and meat scrap per month, those receiving sprouted oats 101.5 pounds, and those without green feed 94.9 pounds, showing

that the feeding of corn s resulted in a considerable saving of grain. The amount of ... eaten during the different months seemed to vary considerably with the different lots of fowls but no reason was evident for this ifference.

Table 2 gives the weight of the 15 hens in each lot from month to month.

TABLE 2.—Weight of Hens in the Different Pens From Month to Month

Pen	Dec. 1	Jan. 1	Feb. 1	March 1	April 1	May 1	June 1
1	48.9	51.0	55.2	56.5	51.2	51.7	50.7
2	48.1	54.5	56.5	58.	52.5	51.8	51.4
3	48.5	54.5	54.	56.	51.5	49.4	46.6
4	48.2	50.0	53.	54.5	51.	50.	47.9
5	48.9	56.0	56.	58.	56.2	55.4	53.
6	47.5	51.0	53.5	55.	50.	47.8	47.
Total	290.1	317.0	328.2	338.0	312.4	306.1	296.6

The fowls increased in weight until March 1. There was then a decrease until the first of June.

During the six months 5 hens died and were replaced by similar fowls, two from Pen 1, and one each from Pens 2, 3, and 4.

Table 3 shows the number of eggs produced by each lot of fowls and the average weight of the eggs for each month of the test in grams.

TABLE 3.—Eggs Produced and Their Average Weight in Grams

	Pen 1		Pen 2		Pen 3	
	No. Eggs	Average Wt.	No. Eggs	Average Wt.	No. Eggs	Average Wt.
Dec.	99	59.88	42	61.40	60	59.65
Jan.	92	59.94	69	60.37	145	57.30
Feb.	147	57.82	91	58.77	114	57.05
Mar.	204	56.87	143	57.38	202	54.86
April	209	56.03	173	57.35	197	53.72
May	244	55.30	209	57.38	228	52.89
TOTAL	995		727		946	

	Pen 4		Pen 5		Pen 6	
	No. Eggs	Average Wt.	No. Eggs	Average Wt.	No. Eggs	Average Wt.
Dec.	110	60.14	84	61.00	60	59.30
Jan.	123	60.94	201	61.21	149	58.45
Feb.	231	60.03	221	61.28	255	57.43
Mar.	269	58.36	284	59.66	288	56.55
April	271	56.45	278	57.96	240	54.56
May	278	55.72	282	57.74	249	53.64
TOTAL	1282		1350		1241	

The total egg production of the three pens shut in was 2,668 eggs weighing 151,091 grams, or an average weight of 56.63 grams. The fowls allowed to run out laid 3,873 eggs weighing 224,429 grams, or an average weight of 57.94 grams. **Not only did the fowls allowed their liberty lay better than the others, but their eggs were heavier.** This increased production and greater average weight of the eggs may have been due to better health induced by the greater activity of the fowls since the mortality was somewhat lower in case of the fowls running out.

Table 4 shows the total number of eggs laid by the six pens, and the average egg weight in grams. During August and September all six pens were allowed to run outside.

TABLE 4.—Total Number Eggs Laid and Their Average Weight

	Dec.	Jan.	Feb.	Mar.	Apr.
No. Eggs Laid.....	455	709	1059	1390	1368
Ave. Egg Wt.....	60.18	59.68	58.93	57.42	56.08

	May	June	July	Aug.	Sept.
No. Eggs Laid.....	1490	1200	950	628	382
Ave. Egg Wt.....	55.49	54.54	54.26	56.63	58.17

During the ten months covered by the record the heaviest eggs were laid in December. From that maximum the weight of the eggs decreased with considerable uniformity until the minimum was reached in July. From then on there was an increase in weight.

Table 5 shows the number of eggs laid and their weight in grams arranged in accordance with the kind of green feed which the fowls received.

TABLE 5.—Number and Weight of Eggs Laid by Fowls On Different Green Feeds

Sprouted Oats		Silage		No Green Feed	
No. Eggs	Weight	No. Eggs	Weight	No. Eggs	Weight
99	5929	42	2579	60	3579
110	6615	84	5124	60	3558
92	5515	69	4166	145	8308
123	7496	201	12304	149	8710
147	8500	91	5348	114	6505
221	13544	255	14644	231	13867
204	11602	143	8206	202	11082
284	16943	288	16286	269	15700
209	11711	173	9922	197	10583
240	13095	271	15298	278	16114
244	13494	209	11988	228	12074
249	13358	278	15489	282	16284
Total 2222	127802	2104	121354	2215	126364
Ave. Weight	57.51		57.67		57.05

The table shows that as far as egg production is concerned it was practically immaterial whethe the fowls received sprouted oats, corn silage, or no green feed whatever, as the no-green-feed lot laid as many within 7 eggs as the fowls receiving sprouted oats and laid even better than the fowls receiving corn silage. These differences, however, are all small and probably within the limits of error and of no significance. The average weight of the eggs was apparently affected but little, if at all, by the presence or absence of the green feed.

It is somewhat commonly believed that the addition of sprouted oats to a ration for laying hens in winter will increase the egg production. This experiment indicates that it makes little or no difference under the conditions of this test whether the oats are fed dry or sprouted. This result is confirmed by the unpublished results of two other experiments conducted by the author some years ago, brief references to which are here given.

DRY VS. SPROUTED OATS

(Experiment Winter of 1912-13)

In this test there were 586 single-comb White Leghorn pullets in one lot and 394 in another. In addition to a basic ration with dry mash fed in hoppers the smaller flock received sprouted oats during the months of December, January, and February. During the next two months the larger flock received sprouted oats. Shredded alfalfa was available continuously to both lots and both had access to outside yards. There was practically no difference in the average egg production whether the oats were fed dry or sprouted.

SPROUTED OATS EXPERIMENT

(Winter 1913-14)

In this experiment five lots of fowls were employed, each lot consisting of twenty single-comb White Leghorn pullets. These were placed in small colony houses 9 feet wide by 18 feet long. Each lot of fowls was allowed the use of a run containing about 1500 square feet but, as the experiment began November 1, practically no green stuff was growing in these runs during the course of the experiment.

The fowls were fed the same basic ration. In addition to this, Pen 5 received sprouted oats. Pen 6 received oat sprouts, the sprouts being cut from oats when about one and one-half to two inches long. Pen 7 received steamed alfalfa. This alfalfa was fed every morning being mixed with a moistened mash. Shredded alfalfa was used for this purpose and it was prepared by placing it in a pail and pouring boiling water over it and allowing it to stand over night. Pen 8 was fed dry shredded alfalfa in a hopper, but as the pullets did not relish this very little was consumed and this pen was, therefore, practically a check pen. Pen 9 received no green stuff of any sort.

All pens were fed a moistened mash every morning consisting of a mixture of bran, corn meal gluten, middlings, meat scrap, and oil meal, and in the evening a mixture of corn and oats was scattered in the litter which covered the floors of the poultry houses.

The average weight of the pullets was 2.6 pounds on November 1 and

owing to their immaturity the egg production was light until the month of March. The following statement shows the total production for the four months ending April 1.

Pen	Green Feed	Eggs Produced
5	Sprouted oats	533
6	Oat sprouts	522
7	Steamed alfalfa	552
8	Alfalfa in hopper	490
9	No green feed	584

There was at least no great benefit derived from feeding the green feed. The pen receiving no green feed laid the largest number of eggs while, if pens 8 and 9 both be considered as check pens, the average production (537) compares favorably with the average of the pens receiving green feed.

The results then of the three tests indicate that there is at least no great benefit derived from feeding sprouted oats for the purpose of increasing egg production in winter. It will be shown later in this bulletin, however, that sprouted oats have a strikingly beneficial effect in increasing the fertility and hatchability of eggs.

HATCHING THE EGGS

From the eggs laid in May four hatches were made. To overcome any possible differences among the males in the six pens these were changed from one pen to another in regular rotation so that each of the six males was mated with the females in each pen once every two days. Table 6 shows the results of the four hatches.

TABLE 6.—Effect of Confinement on Fertility and Hatchability of Eggs

	Confined	Not Confined
Number of Eggs Incubated	637	754
Percent Infertile	23.55	13.26
Percent Hatched of All Eggs Incubated	62.32	77.06
Percent Hatched of Fertile Eggs	81.52	88.83

The table shows that the eggs from the fowls having free access to the yards were much more fertile and that the fertile eggs hatched better than was the case with the eggs from the fowls confined.

During May and June six hatches were made of eggs laid by the fowls fed sprouted oats, silage, and no green feed. The males were rotated as stated above. Table 7 summarizes the results of the hatches.

TABLE 7.—Effect of Green Feeds on Fertility and Hatchability of Eggs

Treatment	Number Eggs Incubated	Percent of Eggs Infertile	Percent of Fertile Eggs Hatched	Percent Hatched of All Eggs Incubated
Sprouted Oats.....	575	18.09	87.90	72.00
Silage	463	17.28	87.99	72.78
No Green Feed.....	676	24.88	82.48	61.98

The eggs produced from the sprouted oats and silage rations were about equally fertile, and hatched about equally well, giving about 72 chicks per hundred eggs set. On the other hand, eggs from the no-green-feed fowls were less fertile and fewer of the fertile eggs hatched, so that about ten percent fewer chicks hatched out.

From the results obtained it seems possible that there is some substance, possibly a vitamine, present in sprouted oats and corn silage which is of importance in the formation of a strong embryo, but which has little if any effect upon the number of eggs laid.

EXPERIMENTS IN 1921-22

As it seemed desirable to repeat, during the winter of 1921-22, the experiments on confinement and the use of corn silage, ninety White Leghorn pullets were divided into six similar lots and placed in the houses used in the preceding experiment.

The test began December 1, 1921, and was continued five months. Lots 2, 3, and 4 were confined to the houses during this period, while Lots 5, 6, and 7 had uninterrupted access to their respective yards.

The grain ration for all lots was the same as in the earlier experiment. In addition Lots 2 and 5 received dried beet pulp, Lots 3 and 6 corn silage, and Lots 4 and 7 no green feed except the small amount that grew in the run which was available for Lot 7. Only the smaller pieces of silage were eaten and, as the fowls did not seem to relish the beet pulp either when fed dry or soaked, a considerable amount of that offered was unconsumed. Two other lots of similar pullets were included in the test to compare the value of meat scrap and semi-solid buttermilk for egg production. They were not confined.

Table 8 shows the number of pounds of feed consumed by each lot of fowls during the 5 months covered by this report.

The mash supplied to Pens 2, 3, 4, 5, 6, and 7 consisted of 2 parts corn meal and 1 part each of wheat bran, wheat middlings, and meat scrap. The mash for Pens 8 and 9 was the same as above except that it contained no meat scrap. The semi-solid buttermilk for Lots 8 and 9 was fed in troughs.

TABLE 8.—Amount in Pounds of Feed Consumed By Each Pen

Pen	Mash	Corn	Oats	Corn Silage	Beet Pulp	Semi-Solid Buttermilk	Treatment
2	283.0	115.0	57.5	.....	43.7	.....	Shut In
3	296.0	115.6	57.8	151.0	.....	.....	Shut In
4	307.0	117.0	58.5	.....	.....	.....	Shut In
5	353.0	115.6	57.9	.....	43.7	.....	At Liberty
6	338.0	115.6	57.8	151.0	.....	.....	At Liberty
7	334.0	117.0	58.5	.....	.....	.....	At Liberty
8	341.0	114.0	57.0	.....	.....	63.3	At Liberty
9	329.0	115.6	57.8	.....	.....	63.3	At Liberty

In harmony with the results obtained the previous year the fowls allowed to run out consumed more feed than did those shut in. The feed consumption was at the rate of about 75 pounds per bird per year.

WEIGHT OF FOWLS

The fowls were weighed individually at the beginning of the experiment, and at the end of each calendar month thereafter. Table 9 shows the weight of the 15 pullets in each lot from month to month.

TABLE 9.—Weight in Pounds of the Fifteen Pullets in Each Pen

Pen	Dec.	Jan.	Feb.	Mar.	April	May	Average
2	44.2	49.6	52.1	52.2	49.7	46.5	49.0
3	47.4	52.3	53.0	56.3	51.7	48.0	51.4
4	47.1	52.6	52.9	54.3	51.9	48.3	51.2
5	47.0	51.9	53.0	55.7	53.6	53.1	52.4
6	46.7	49.2	51.6	53.6	51.6	49.1	50.3
7	48.0	48.3	52.2	54.7	50.8	52.6	51.1
8	47.6	48.5	52.3	55.1	53.3	53.6	51.7
9	46.8	50.4	53.7	55.5	51.8	50.0	51.4
Average	46.8	50.3	52.6	54.7	51.8	50.1	

The pullets averaged about 3.5 pounds in weight throughout the test. The maximum weight was reached in March, or just prior to the maximum egg production of the season.

TABLE 10.—Number of Eggs Laid and Their Weight in Grams

Month	Pen 2		Pen 3		Pen 4		Pen 5	
	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.
December	107	5193	105	4954	126	5920	127	5990
January	166	8337	167	8556	160	8174	181	9270
February	204	10776	154	8241	171	9217	180	9335
March	197	10432	249	13630	169	8983	289	15459
April	191	9713	224	11890	166	8760	298	15829
TOTAL	865	44451	899	47271	792	41054	1075	55883

Month	Pen 6		Pen 7		Pen 8		Pen 9	
	No.	Wt.	No.	Wt.	No.	Wt.	No.	Wt.
December	151	7326	100	4580	118	5731	61	2737
January	204	10389	120	5850	146	7401	174	8666
February	233	12168	178	9297	211	11002	258	13256
March	320	17026	260	13878	296	15618	309	16021
April	287	15083	287	15237	297	15169	302	15501
TOTAL	1195	61992	945	48842	1068	54921	1104	56181

The three pens shut in laid 2,556 eggs with an average egg weight of 51.95 grams while the three similarly fed pens at liberty laid 3,215 eggs with an average weight of 51.86 grams. The fowls at liberty led in egg production, but the average egg weight was practically the same in both cases.

The two pens receiving corn silage laid 2,094 eggs averaging 52.18 grams; those receiving beet pulp laid 1,940 eggs averaging 51.72 grams; and the two pens not receiving green feed laid 1,737 eggs with an average egg weight of 51.75 grams. The fowls receiving the corn silage led not only in number of eggs but also in egg weight.

MEAT SCRAP VS. SEMI-SOLID BUTTERMILK

Pens 7, 8, and 9 were fed and handled similarly except that Pen 7 received meat scrap and Pens 8 and 9 were fed semi-solid buttermilk in lieu of scrap. Pen 7 laid 945 eggs averaging 51.61 grams and Pens 8 and 9 averaged 1,086 eggs with an average weight of 51.15 grams.

HATCHING THE EGGS

Beginning on March 12 the eggs from all pens were incubated in Cyphers incubators. To avoid any differences in fertility due to possible differences in the vigor of the males these were changed systematically from one pen to another each day so that each of the eight males was mated to each pen of fowls once every eight days. Table 11 shows the results of the six hatches made.

TABLE 11.—Effect of Green Feeds and Confinement on Fertility and Hatchability of Eggs

Treatment	No. of Eggs Incubated	Percent Hatched of All Eggs Incubated	Percent of Fertile Eggs Hatched	Percent of Eggs Infertile
No Green Feed, Shut in	154	31.82	52.13	38.96
No Green Feed, at Liberty	289	70.24	80.56	12.80
Average, Both Lots		56.89	72.83	21.90
Corn Silage, Shut in	259	42.08	68.13	38.22
Corn Silage, at Liberty	343	71.43	91.42	21.87
Average, Both Lots		58.80	82.71	28.90
Beet Pulp, Shut in	210	47.14	67.35	30.00
Beet Pulp, at Liberty	322	65.84	84.13	21.74
Average, Both Lots		58.46	77.94	25.00
Fowls Shut in.....	623	41.25	64.09	35.63
Fowls at Liberty..	954	69.18	85.49	19.08
Pen 7, Meat Scrap	289	70.24	80.56	12.80
Pen 8, Buttermilk	312	80.77	94.03	14.10
Pen 9, Buttermilk	320	72.50	88.89	18.44
Average Pens 8, 9		76.58	91.49	16.30

The eggs laid by the fowls at liberty hatched much better than did the eggs from the fowls confined, the average being about 69 chickens per hundred eggs set in the first case and 41 chickens per hundred eggs in the other. This result conforms with the result obtained in the previous experiment, and is in agreement with practical experience.

The presence or absence of corn silage or dried beet pulp seemed to have but little effect upon either fertility or hatchability although slightly more of the eggs hatched that were laid by the fowls receiving corn silage.

The eggs laid by the fowls receiving semi-solid buttermilk, although somewhat less fertile, hatched slightly better than did those from Pen 7. The health of the fowls receiving semi-solid buttermilk was good. This material is evidently a valuable carrier of protein and ash constituents in rations for egg production.